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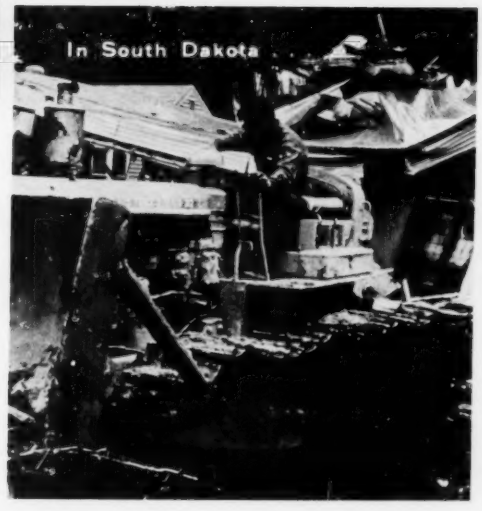

DEVASTATION!

They Stayed Until the Job Was Done

AIR FORCE Civil Engineer

USAF RECURRING PUBLICATION CE 85-1 VOL 14 NO 1 FEBRUARY 1973

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Maj Gen M. R. Reilly	Director of Civil Engineering, HQ USAF
Col Albert N. Nemetz	Director, Civil Engineering School
George K. Dimitroff	Editor, Civil Engineering School
Roger F. Butler	Art Editor, Air Force Institute of Technology

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The AIR FORCE CIVIL ENGINEER is an official, nondirective HQ USAF publication, published quarterly under provisions of Chapter 2, AFM 5-1. Its purpose is to provide timely information to Air Force Civil Engineering personnel relating to mission accomplishment; to assist them in solving problems and improving efficiency of operation; to communicate new developments and techniques, and to stimulate professional thought and development. The Journal is edited and published by the Civil Engineering School, Air Force Institute of Technology. Contributions, suggestions and criticism are welcome.

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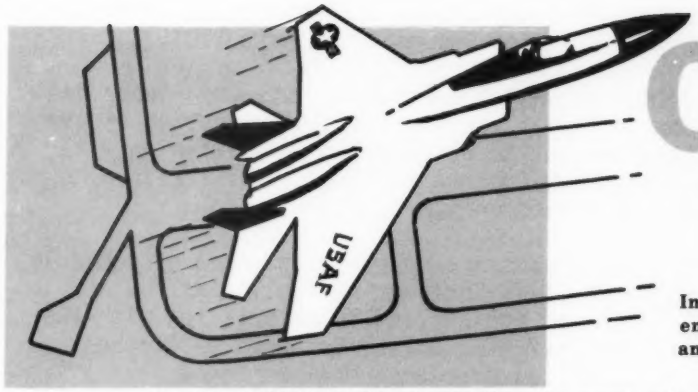

Current Emphasis

Information published here is designed to keep civil engineering personnel aware of late developments and significant trends within the career field.

AICUZ APPROVED BY CONGRESS--As part of the FY 1973 MCP, Congress has approved the Air Installation Compatible Use Zone program to protect the civilian community from aircraft noise and safety hazards around airfields. AICUZ increment included $12 million authorization and $2 million appropriation to be used if zoning and exchange efforts fail at Altus, Tinker and Williams AFBs.

ARSON TECHNIQUES COURSE INITIATED--Arson Techniques for Fire Protection Supervisors, Course 4AST57150-2, is now being conducted by travel team from the Fire Protection School, Chanute AFB, and can be requested in accordance with AFR 50-9. Designed to teach the requirements for fire investigation, fire causes, types of investigations and procedures in conducting fire investigations, the course is 30 hours in length.

CHANGE IN PROGRAMMING MANUAL--AFM 86-1 has been delayed for streamlining content.

FY 1974 OPERATIONS BUDGET REVIEW--Submissions of FY 1974 OOBs will be reviewed at USAF between March and May 1973. Civil engineers must furnish Comptrollers complete narratives to justify requirements and explain reasons for changes between FY 1973 and FY 1974.

REVIEW GROUND MAINTENANCE EQUIPMENT--Now is the time to insure that spare parts have been ordered for ground maintenance equipment. A review now will prevent undue delays in the Spring when the equipment is required.

IG INSPECTION OF SPECIAL SERVICES--The civil engineer is criticized for failure to reflect accurate NAF projected construction program in the Z 17.

EQUIPMENT ALLOWANCES--Field tests reveal that equipment allowances in TA929 will not support BDR requirements reflected in AFM 93-2. A request to increase the number of electric drills (1 to 6), impact wrenches (1 to 3) and drill bits (8 to 50), per batch kit, has been directed to AFLC. Pending publication, BCEs are urged to use TA987 procedures to request additional items.

FACILITY REQUIREMENTS CRITERIA--Revised facility requirements and space criteria for religious, welfare and recreational facilities have been distributed to all MAJCOM headquarters. The criteria provide space allowances for 11 newly authorized facilities and increased space allowances for nearly all authorized facilities.

ENLARGED MOWER CUTS COSTS--Base Civil Engineering at Robins AFB, Georgia, recently converted a 15 foot rotary mower to a 25 foot cutting model. Engineers believe that the enlarged mower enables a substantial cost savings in that approximately 140 to 160 acres of grass can be cut daily (8 hours).

PRIME BEEF REPORTING--Base level Prime BEEF (continued on next page)

managers should visually audit the Prime BEEF military requirements depicted in BRASS reports to insure that totals by AFSC correspond with requirements contained in column J of the official Prime BEEF Planning Document, AF Form 1183.

AFM 85-1 FOLLOW-ON TRAINING--Beginning next month, Sheppard Technical Training Center will conduct 40 hour AFM 85-1 revisions training courses by use of mobile training teams. Locations are yet to be established. Training will be directed toward Chiefs of Programs, Work Control and IE, who will return to bases and provide training for other BCE personnel.

A NEW EDUCATIONAL OPPORTUNITY--Plans are progressing ahead of schedule for the awarding of a master's degree in Civil Engineering/Facilities for Air Force Civil Engineers by the AFIT School of Engineering in association with the Civil Engineering School at Wright-Patterson AFB, Ohio. Designed to further develop the engineers' abilities in technical problems, engineering analyses and solving problems unique to civil engineering, the first offering will be in the Fall of 1973, with a quota of 20 spaces. Interested personnel should contact the Admissions Directorate, AFIT/RR, Wright-Patterson AFB, Ohio 45433, or PALACE BLUEPRINT, AFMPC/DPMRCS2B, Randolph AFB, TX 78148.

MFH SELF-HELP SUPPLY STORE TEST--Family housing occupants are interested in their quarters and are willing to repair many small items that fail, according to a recent test. Data provided by McGuire AFB indicate an average of 3,282 line items issued each month for an average cost of $4,016. Labor cost to operate the store averages $758 monthly. The test also indicates a decrease in service calls and job orders received from the Military Family Housing area.

INFLATED INDUSTRIAL ENGINEER SAVINGS--Quantity and quality of industrial engineering management review studies continue to improve. However, examination of recent RCS:HAF-PRE(AR)7126 reports revealed that some cost savings reported were highly inflated.

INSPECTION COULD SAVE A LIFE--Within the past six months, two accidents have occurred as the result of defective wire rope. TO 36-1-58 provides guidance for its inspection. If you doubt the safety of wire rope, request the cable be replaced. It could mean your life.

RESTRICTIONS ON USE OF AND DISPOSAL OF DDT--An EPA order cancelled several uses of DDT for bat control, mouse control, control of stored products pests and pests of wool and other animal fibers. Excess DDT formulations should be held in suitable storage to prevent deterioration of containers. Storage is necessary until approved disposal methods are available.

MEDICAL FACILITIES--are Special Interest Items coordinated through various echelons of DoD. Therefore, expeditious handling of these items must be rigidly managed from submittal of preliminary study, issuance of the design instruction, predesign conference and the concept and final planning phases.

REPORT SPILLS PROMPTLY--POL spills continue and, in some cases, have not been reported promptly. Oils and toxic substance entering water are environmentally hazardous, embarrassing and costly. Civil engineers should insure that their spill contingency plans thoroughly cover prevention, notification and containment. Don't overlook contract operated functions!

GOOD NEWS AT DEADLINE--Col Frank G. Barnes, DCS/Civil Engineering, Headquarters Tactical Air Command, Langley AFB, Virginia, and Col William D. Gilbert, DCS/Civil Engineering, Headquarters Military Airlift Command, Scott AFB, Illinois, have been nominated for promotion to the rank of Brigadier General.

The "New Look" at AF/PRE

When names and numbers of blocks on an organizational chart change, the question arises: Who is doing what now? That question and many others that have been received since the Directorate of Civil Engineering (AF/PRE) has undergone some recent changes, are answered in the paragraphs that follow.

The first noticeable feature of the current organizational chart is that the Civil Engineering Center and the three Air Force Regional Civil Engineers (AFRCEs) are no longer with AF/PRE. The Center was transferred to Air Force Systems Command (AFSC) in June 1972 (See November 1972 **Air Force Civil Engineer**) as part of a Headquarters US Air Force program to eliminate all field extensions of the Air Staff. Now at Tyndall AFB, Florida, the Center continues to perform its unique role of civil engineering services for all commands, and maintains a close technical and advisory relationship with AF/PRE. Its Commander reports to the Commander of AFSC.

The San Francisco, Dallas and Atlanta AFRCEs are now detachments of the 1137th Special Activities Squadron of Headquarters Command. Their job remains the same, to interface with the Army Corps of Engineers and Naval Facilities Engineering Command when acting as construction agents of the Air Force. Strong ties are necessarily maintained with the offices which function as field representatives of the Construction Division at AF/PRE.

The Directorate of Civil Engineering, now down to about 300 people, compared to 550 two years ago, is presently configured as shown in **Figure 1.**

The Plant Engineering Division has now become the **Engineering Division.** The fire protection function was moved here from the Civil Engineering Center as were the over-all direction of the investigational/applications engineering and corrosion control. Problems encountered in the span of control and the unique day-to-day responsiveness required in construction management led to reestablishment of the **Construction Division,** colocated at Bolling AFB with the Engineering Division. The old Engineering Operations Branch was moved essentially intact to the Construction Division, along with the functions of construction and design management.

The Real Property Agency, also at Bolling AFB, became the **Real Property Division** when Headquarters US Air Force field extensions were eliminated. It has been reconfigured from three to two branches by combining the Strategic/Support/Overseas Branch and the Defense/Tactical/Training Branch into a new Real Estate Branch.

Management Division is now known as the **Maintenance/Management Division.** In a streamlining change, Industrial Engineering and Systems Management Branches were combined into the Systems Engineering Branch. Operations and Maintenance (O&M) budget functions and financial management were moved from Programs Division and combined with Force Management to form the new O&M Resources Branch. Contingency planning, the policy making aspects of Prime BEEF and RED HORSE, and personnel/training functions were moved from the Center to form the new Planning/Operations Branch.

New features in the **Civil Engineering Programs Division** include an Operations Branch, comprised of action officers assigned to individually manage all facets of rapidly moving projects and programs. The Military Construction Program is managed by the Military Construction Branch while O&M and nonappropriated fund projects are processed by the Policy and Criteria Branch.

The **Housing Division** and the **Environmental Protection Group** remain organizationally unchanged.

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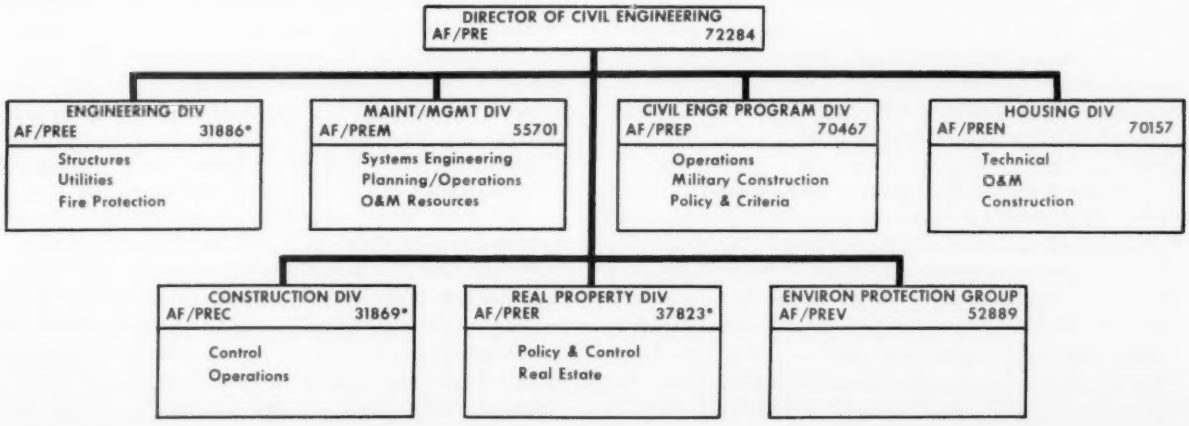
Figure 1: Directorate of Civil Engineering Organization.



*Bolling AFB Autovon 11

Homes were lifted off their foundations and porches swept away as raging flood waters ripped through Wilkes-Barre.

After flood waters receded, scenes such as this flattened home were commonplace throughout Wilkes-Barre, Penna.

Hurricane Agnes blew up a real storm last June and left devastation that, in size, is being termed the worst natural disaster in American history. Civil engineers responded, displaying their professionalism, and more importantly, their human side during the massive recovery operations.

They Stayed Until the Job Was Done

by Capt Edward M. Smith

■ For seven years, Air Force Civil Engineering has surged ahead through formulation, development and utilization of its Prime BEEF and RED HORSE concepts. No challenge has yet been too great to accept, as civil engineers have consistently delivered to meet the many varied requirements. But nothing has brought out both their professional and human side as did the challenge in the Wyoming Valley of Pennsylvania during the Fall of 1972, when Prime BEEF and RED HORSE troops teamed up to lend a helping hand.

Deployments to Micronesia, Thailand, Iran, Eniwetok, the Azores and movements in support of Southeast Asia had already severely depleted Prime BEEF (Base Engineer Emergency Force) resources when Hurricane Agnes, first of the 1972 hurricane season, blew up the East Coast of the United States in June. Devastation was widespread and a sudden further need for federal assistance had arisen. The devastation was of such magnitude that President Nixon sent a personal ambassador, Mr Frank Carlucci, to coordinate all Federal efforts in the flood stricken area. Mr Carlucci, in conjunction with the Office of the Assistant Secretary of Defense and the Office of Housing and Urban Development, requested that the combined engineering resources of the Army, Navy and the Air Force be brought to bear on the problems of providing desperately needed housing for families uprooted by the disastrous floods. Headquarters Air Force responded immediately with a joint Prime BEEF/RED HORSE Team, 73-2, appropriately termed Ready Repair Team by Mr Carlucci.

To more fully comprehend the situation, it is necessary to briefly review the hurricane's behavior. Agnes started as a small tropical storm in the Caribbean during early June, gradually increased in proportion to become a full-fledged hurricane, and then swept across the Florida coast on the 19th. Heavy rains extended all the way up the eastern seaboard. After passing through Georgia and the Carolinas, the

storm headed to sea and the danger period appeared over. However, once in the Atlantic, Agnes reformed and moved slowly westward across New York State. Then, on 24 June, she looped back over Pennsylvania before finally weakening.

Flooding of disastrous proportions resulted. The Susquehanna River, which splits the cities of Kingston and Wilkes-Barre, exceeded its previous record flood stage by seven feet. Flood waters topped levees by four feet and, in many low lying areas, water filled homes, public buildings and business establishments to their second floors. Utilities, telephones and essential services were eliminated; mud slides closed roads; and several bridges across the Susquehanna River were destroyed or severely damaged. The destruction in terms of property damage totaled $3.1 billion and, in size, was termed the worst natural disaster in American history.

such as this, many small problems can become very annoying in a new home. We hope to bridge the gap for these citizens occupying federally supplied mobile homes by performing small chores . . . "

The mobile homes, which HUD provided rent free for one year, could either be located in the Army constructed emergency mobile home parks or adjacent to private homes. Many of the families who chose to personally rebuild their homes located the mobile homes next to their damaged homes, working on them as time permitted.

The 819th Civil Engineering Squadron (Heavy Repair) responded to the initial call for Air Force personnel because of the close proximity of its home station, Westover AFB, Massachusetts, and the fact that the RED HORSE squadron was fully equipped to meet the task. Prime BEEF personnel were to augment the composite team as required. On 22 August,

. . . making electrical repairs

. . . repairing a door frame

. . . fixing a jammed door

. . . checking a water heater

Once the long, tedious job of debris removal and essential utility restoration was completed, the major task was to provide suitable housing for the huge number of people who either had lost their homes or had them severely damaged. With the realization that a cold, icy winter, common in Northeastern Pennsylvania, was rapidly approaching, the job took on added urgency. The Department of Housing and Urban Development (HUD) immediately procurred 8,000 mobile homes from all available sources in some 17 states. The Army readied 33 sites in the area and tasked civilian contractors to provide suitable pads for the mobile homes.

Air Force Civil Engineers (AFCEs) were requested to provide necessary mobile home maintenance, once families moved into the units. Explaining the Ready Repair Program, Mr Carlucci stated, "This is a personalized effort to help new residents of emergency mobile homes to get established in their new quarters. We recognize that, in a crash program

20 personnel from the 819th deployed with four jeeps, two ¾ ton cargo trucks, and two pickup trucks. The team consisted of carpenters, electricians, plumbers, vehicle mechanics and other skills. The only officer served as the Team Chief. One week later, with the heavy workload more specifically defined, five major commands responded with seven, three-man crews. Two each were sent from MAC and TAC, and single crews came from AFLC, AFSC and HQ COMD. Each crew brought a pickup truck which it would use for transportation to the varied job sites in the area. By the first week in September, the 41 man effort was in full operation.

The Team Chief organized the personnel into 11 working crews, most consisting of three men. Initially, many home parks were still being readied, so work centered at individual homesites. Crews were assigned to specific geographic sections of Kingston and Wilkes-Barre, with several crews responding to

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They Stayed
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areas adjacent to the Susquehanna River, which were damaged the worst. Service calls were received through a central HUD office and relayed to an Air Force scheduler, who passed them on to the various crew chiefs.

Although most of the work was not difficult for experienced civil engineering craftsmen, the plight of the people provided an abundance of challenge. The rush to provide mobile homes coupled with the hundreds of miles transported, took a toll on many units. Upon arrival, trailers were placed at sites all over the area and tied to any existing utilities.

HUD, working under a crash program to provide homes to all people who required them, often could not put emphasis on the finishing touches. Families, who had already been subjected to overwhelming stresses in seeing their homes demolished, often overreacted to the many problems that developed in their new, temporary homes. The Ready-Repair crews did their best to put on the finishing touches and make other needed repairs. Finish leveling of the mobile home was accomplished, leaking utility connections repaired, heating units were checked for proper functioning, and light switches, floor tile and woodwork often required minor repair.

Hundreds of calls were received and each one became four and five separate jobs. Residents desired everything fixed when a crew appeared, even if the work did not appear on the job order. They often acted fearful that, when a crew moved on to another trailer, they would never see them again. If an airman went for additional supplies, he had to reassure them of his return. Aware of this anxiety, crews remained sympathetic and eager to help. Morale was never a problem despite long 60 and 70 hour workweeks.

This was one of 33 mobile home sites established for families who lost homes as the result of Hurricane Agnes.

One early problem dealt with supplies. Hand tools and materials had to be obtained from a central HUD supply facility. With some men located as far as 15 miles away, continuous trips resulted in a substantial loss of time. The Team Chief pursued the issue and HUD authorized local purchasing authority from several designated merchants. Wooden boxes were also constructed on each vehicle, allowing large quantities of supplies to be transported. Both actions saved valuable time. Purchasing supplies on a required basis turned out to be a very workable solution. Despite flood damage, the designated outlets had adequate stocks of the common, required items. Those which were unavailable, could quickly be retained from out-of-town sources. Using local resources, in addition to saving time, helped boost the local economy.

As crews became increasingly familiar with the area, efficiency increased. But the real impetus came in late September when the job totally shifted from individual sites to the newly constructed mobile home parks. With travel time minimal, crews responded to from 75 to 100 calls daily.

Vehicles held up well in view of the thousands of miles driven. Minor repairs and the replacement of several worn tires were performed at a single, Army contracted service station, where all government vehicles were serviced.

Whenever civil engineers are involved, there are always a few extraordinary requests and Wilkes-Barre was no different. In one instance, a crew assisted when a boiler in a private home was in danger of rupturing. Another crew responded to the pleas of a minister whose church doors were stuck due to the water. The church doors were repaired and Sunday services were held as scheduled. Still another circumstance saw the team pitch in and assist the Navy Seabees with exterior utility hookups to unoccupied trailers.

When the program was turned over to HUD in late October, AFCE crews had repaired 1,533 trailers at individual sites and 1,904 in trailer parks, for a total of 3,437. On 26 October, the last Ready Repair personnel and equipment departed for Westover AFB after an exceptionally busy and productive two months. Obviously, they had accumulated a few thousand new friends.

While many residents took advantage of the federally supplied trailers, the majority still wanted to return to their homes as soon as possible. To accommodate them the Mini-Repair program was made available by the Office of Emergency Preparedness. This program allowed enough basic repairs to make a house habitable, and those electing it gave up the opportunity to move into Government furnished temporary housing.

Since almost 2,800 homeowners were eligible,

and with work to be completed in a short 30 to 45 day period, the Army requested Air Force assistance to monitor civilian contractors. Experience in contract surveillance was essential since there was no time to become familiar with either Army inspection methods or contractor capabilities.

In mid-September a second increment of 40 civil engineering personnel arrived in Wilkes-Barre. The same composite Prime BEEF-RED HORSE approach was used. Carpenters, electricians, plumbers and heating specialists were deployed from the 820th CES (HR) at Nellis AFB, Nevada, and from ADC, ATC and AFCS Prime BEEF resources.

Mini-Repair represented work essential for safety and utility services. It consisted of fixing roofs, supporting weakened foundations, repairing doors and windows, and insuring houses were tied into electrical, gas, sewer and water sources. Initial guidelines limited the cost of repairs to $3,000 per unit.

Teams Monitor Single Contractor

Two 20-man Air Force teams were established, each to monitor single contractor, Kohler and Morrison-Knudsen. Team Chiefs were given Contracting Officers Representative (COR) authority. With almost 1,000 individual contracts involved, a massive number of daily interim and final inspections resulted. The hasty mobilization forced several complications to arise. Architect-Engineer firms were given such short periods to develop contracts that scopes of work were often inadequate or incomplete. Over 850 change orders resulted and each had to be coordinated among the homeowner, contractor and COR. The $3,000 limitation became a nemesis, often prohibiting job completion. Contractors made every effort to keep homes in the program by cutting corners; however, this only resulted in homeowners becoming unhappy with workmanship. As a partial solution, CORs were given blanket authority to run costs to $3,500 per unit. This helped, but still many contracts had to be reevaluated and, in some cases, portions of work eliminated.

Despite numerous efforts to publicize and explain the options available under the Mini-Repair program, many residents misunderstood the full details. Federal, State and Local assistance agencies were available to receive queries from flood victims; but oftentimes, when they were unaware of work pertaining to specific contracts, they had to refer the individual to the Mini-Repair office. Such a volume of questions was generated that, at times, it took five airmen to man the phones and relay problems to the field. Answers were not always easy since, in addition to national building codes, the construction practices of 16 local communities had to be considered. Despite the complications, Mini-Repair efforts achieved notable results. Both teams, using 20 vehicles and several radios, were able to complete 957 final inspections, or 35 percent of the total program effort. The remaining 1,808 homes were inspected by Army Corps inspectors.

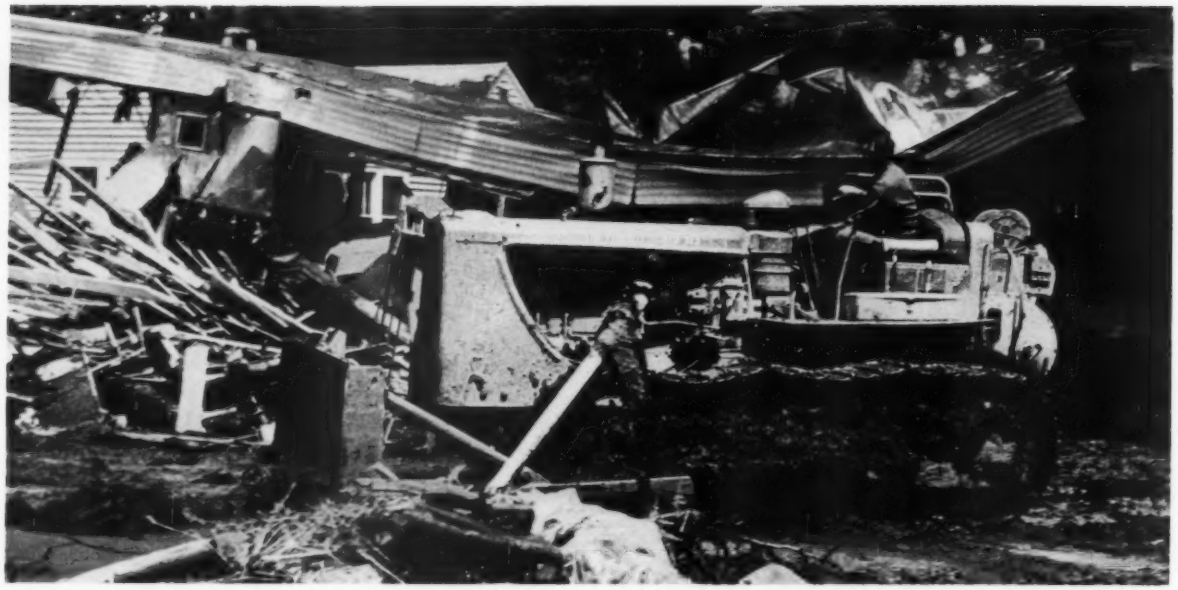
CAPTAIN SMITH *is a Planning and Operations officer in the Maintenance/ Management Division, Directorate of Civil Engineering, Headquarters US Air Force. A graduate of the University of Rhode Island with a bachelor's degree in civil engineering, he holds membership in the Society of American Military Engineers. He previously was Prime BEEF staff officer with the Civil Engineering Center, Wright-Patterson AFB, Ohio.*

Due to the heavy workload, local utility companies were delayed in their efforts to initiate service to all homes. This deferred completion of the Air Force efforts. Although some personnel departed in late October, the last few left on 17 November. All in all, Mini-Repair results were certainly no less successful than Ready-Repair, although somewhat less glamorous.

Throughout the entire Wilkes-Barre effort, AFCEs demonstrated amazing versatility and genuine compassion for the thousands of flood victims. Morale of the entire 81-man team remained visibly high throughout the 90-day deployment despite a prolonged TDY generated quickly with no forewarning, being in an area with no major military installation nearby for support, and working long, tiring hours in a somewhat depressed atmosphere. It is interesting that many team members volunteered to go to Wilkes-Barre, some being from the area and feeling a responsibility, and others simply wanting to help.

Team performance was best summed up in a statement by Maj Gen J. W. Morris, Army Director of Civic Works. Commenting on Prime BEEF-RED HORSE Team 73-2, he said, "It was a pleasure to have worked with the elements of the Air Force Civil Engineering units. As an organization, the Corps of Engineers finds itself involved in many major disaster recovery operations. We feel fortunate, in this case, to have had such highly professional units as Prime BEEF and RED HORSE working alongside us. They came when the people really needed help and stayed until the job was done. The long hours and enthusiastic work of the airmen have been a major contribution in the Federal Government's program of providing adequate housing for the people of the Wilkes-Barre area before winter arrived. They were true professionals at work."

Wilkes-Barre was a professional effort in every respect. The men of Prime BEEF-RED HORSE Team 73-2 met the challenge, and whether they were Prime BEEF or RED HORSE was unimportant; they were civil engineers. Their entire performance typified the "Can Do—Will Do" motto that symbolizes the whole spectrum of Air Force Civil Engineering. CE



Heavy equipment operators from Ellsworth AFB begin the tedious task of cleaning up after the ravaging flood waters raced through Rapid City. The 821 CES spent over 10,000 manhours in six days of clean-up operations.

Killer flood waters raced through Rapid City, South Dakota last June. Using the Prime BEEF concept of operations, civil engineers from Ellsworth AFB pitched in to assist in search, rescue and recovery operations. Here's the report on their actions.

Engineers Help A Community Recover

by Maj Edward E. Vigee

Roadways throughout the area were washed out and automobiles were tossed about like toys by the flood waters.

The Air Force lifted all types of cargo into the stricken area, including a Salvation Army emergency canteen.

The billowing gray clouds began to gather at 5 p.m. as they had for nearly a month over the Black Hills of South Dakota. It was late in the afternoon on Friday and many people were on their way home with plans for a normal Friday evening—a party, visiting with friends or perhaps going camping. But this night was 9 June and for Rapid City, South Dakota, Ellsworth AFB and neighboring smaller towns, it was to become a night of terror and destruction.

Heavy rain drenched an area from nearby Mount Rushmore north for 75 miles, and did not let up for hours. It was no ordinary rain. Water plummeted from the sky in unrelentless furor and was accompanied by severe lightning.

Rapid City, a small community of 44,000 nestled in the foothills of the Black Hills, the gateway to such famous tourist attractions as Mount Rushmore, Deadwood and the Badlands, lost nearly 250 of its citizens in that one night, and property damage reached $100 million.

Although afternoon thundershowers were not unusual for this time of year, there was one weather condition that was unique, the storm was stagnant. Meteorologists of the National Weather Service at Rapid City Regional Airport reported a severe storm on their radar at about 6 p.m., with the rain beginning shortly thereafter.

The storm hovered over the area all evening, sending down as much as 14 inches of rain in some areas. Rapid Creek, the main stream emanating from higher elevations, meanders through Rapid City, cutting through both residential and business sections. The water had to go somewhere and its natural course was Rapid Creek. By 7:15 p.m., a flood alert had been issued, even though at that time, conditions did not yet justify it. The mayor of Rapid City urged all citizens residing within five blocks of Rapid Creek to prepare to evacuate their homes.

An Air Force crane, manned by an Ellsworth AFB recovery team member, lifts a gas tank during recovery operations.

MAJOR VIGEE *is Chief, Operations and Maintenance, 44th Civil Engineering Squadron, Ellsworth AFB, South Dakota. A graduate of the US Naval Academy with a bachelor's degree in engineering, he received his master's degree in management from the University of Denver. He was selected for the rated supplement to enter the civil engineering field and is a command pilot.*

Most people just would not believe that the water would actually affect them, even though an enormous 10 foot high wall of water was headed for the city by 9 p.m., crashing through Dark Canyon, a modern residential section southwest of Rapid City on Rapid Creek.

By 11 p.m., the wall of water had hit a small dam, crashed through the already strained earthen barrier, and unleashed killer waters that raced through the rest of the town.

The dawn broke, finding the devastated town in shock. Many of the residents living along the creek didn't leave their homes and so were washed away, many times still in their homes. As search and rescue operations began everyone seemed to be affected in some way, whether it was by loss of a loved one or by property loss.

Base Not Affected by Flooding

Recovery was tedious. The community was very fortunate in two respects, a summer encampment of the local Army National Guard and the proximity of Ellsworth AFB. The Base went into immediate action, supplying both men and equipment to start the search and rescue and then the recovery efforts. Located 12 miles northeast of Rapid City, the Base is situated on a plateau, approximately 300 feet higher than the community and removed from any flooding stream. The only possible immediate danger to the Base was in terms of communication channels with the ICBM Minuteman Missile sites located throughout western South Dakota. Because of these facts, the Base of approximately 6,000 assigned military personnel was also able to take immediate action to aid the beleaguered town.

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SSgt Otis Matthews, a member of the 821 Civil Engineering Squadron at Ellsworth AFB, lost his life during rescue operations at Rapid City, South Dakota. The Airmen's Medal was awarded posthumously to his family. At least 225 persons in the area lost their lives as a result of the flood.

AFCEs Help *cont'd*

The first organized action taken was establishment of a disaster control center in the Base Command Post where all actions were monitored and coordinated with the Civil Defense Control Center to insure a concentrated effort. The Base Civil Engineer served as the Military Liaison Officer and worked a continuous 48 hours during the most crucial period of the disaster.

The command of the 821st Civil Engineering Squadron (now the 44th CES) was assumed by the Chief of Operations and Maintenance who used military personnel living on base as volunteers for recovery operations. While the Prime BEEF (Base Engineer Emergency Force) Team concept of civil engineering operations was considered and utilized in assignments of specialists for particular demands, such as equipment operators, the civil engineering work force responded to demands placed upon it through the Civil Defense Control Center. A total of 126 vehicles were dispatched, which included busses, wreckers, dump trucks, cranes, tractors, loaders, a pumper, water trucks and a variety of other type vehicles and equipment such as generators and mobile lights.

Approximately 1,500 base personnel, and base facilities, including the hospital, gymnasium, dining hall and Community Center, were made available to the community. Other assistance included helicopters flying search and rescue sorties, and trained personnel restoring vital power and communications links. Potable water was a most precious commodity, and was supplied from the base deep wells.

Up to six months after that freak evening in June when the flood ripped through the community of Rapid City, the citizens were still thinking it was only yesterday. But immediate actions had been taken with the help of many governmental agencies to insure the Rapid City area would rebuild. Air Force personnel, many with combat experience, and including the Civil Engineering forces, organized, equipped and in being, performed in such a manner so as to earn the Outstanding Unit Award and recognition for many exceptional feats of heroism.

Although the torrential rain was supposed to be a once-in-a-hundred years occurrence, plans are now being made to establish a flood plain where no building will be allowed. Rapid City has learned a hard and valuable lesson that other communities might well heed. It can happen to you. CE

Porous Friction Course Makes CONUS Debut

An Air Force precedent was established in September 1972 with the resurfacing of the primary runway at Pease AFB, New Hampshire, with the application of open-textured asphaltic concrete as the wearing course for the runway interior. This porous, free-draining material was developed by the British and first identified for potential Air Force-use during Project COMBAT TRACTION, a joint NASA-Air Force runway skid-resistance study.

The porous asphaltic concrete has been used as a friction course overlay on five runways in Germany and the United Kingdom, but the application at Pease AFB was the first of its type to be constructed on an operational Air Force base within the CONUS. It was also the first time this promising anti-skid surfacing material has been placed on an existing pavement structure without extensive surface preparation. The overlay was preceded by heater-planer removal of some asphaltic material to produce the desired transverse grades for proper drainage, and then a nominal quantity of hot-mix asphaltic concrete was placed as a leveling course in certain areas. Predominately, however, the new surface was placed directly on the existing pavement at an average thickness of three-fourths of an inch.

The runway overlay at Pease AFB affords civil engineering with the opportunity to observe and evaluate the performance of the friction course under aircraft traffic, frequent periods of freeze-thaw activity, and the effects of snow removal/ice control operations. Porous friction courses show promise as excellent surfaces for the prevention of aircraft hydroplaning as well as significantly improving runway traction.

The Civil Engineering Center, Tyndall AFB, Florida, is conducting the materials evaluation for assessment of durability, effects of freeze-thaw cycling and operational performance of porous friction courses. Its study should be completed by the end of fiscal year 1973, at which time further guidance on the use of the material will be issued to the major commands and bases.

CE

Elmendorf Firemen Foam It Away

This was the scene after the train-truck collision in Alaska. Elmendorf AFB fire fighters are shown as they moved in closely with their foam fighting apparatus and quickly extinguished hot spots in the petroleum-fed fire.

Air Force Civil Engineering fire fighters from Elmendorf AFB earned the plaudits of Anchorage, Alaska, fire officials as the result of their efforts in containing a devastating fire on a wrecked freight train, laden with over 100,000 pounds of petroleum products, last August.

The fire and resulting explosions were the aftermath of a collision between the 100-car freight train and a tanker truck at a crossing on the Anchorage-Fairbanks Highway, 50 miles north of Anchorage. No one was injured but damage estimates were placed at $800,000 by railroad officials.

When the Elmendorf AFB fire fighters arrived on the scene at 8 p.m., little did they know that their services would be required for 16 hours. Working through the night with their specially equipped foam dispensing truck, they extinguished the raging fire by 4 a.m. the next day. Six hours later however, the fire was rekindled by workmen attempting to move wreckage to reopen the railroad tracks. The Air Force fire fighters used their expertise well as they attacked the rekindled inferno and brought it under control for good. Salvage operations were resumed, but cautiously.

"It was a real good joint operation," Greater Anchorage Area Borough Fire Marshall Joseph Hildreth said. "The fire fighting units from the Borough, Wasilla, the Bureau of Land Management and the Air Force worked very well together.

"But without the equipment and the bulk quantities of foam that the Air Force provided, we would never have put out that fire," he said. . . . "Considering everything, I think that the job the Air Force crews did was just fantastic."

Alaska fire officials, after an aerial and ground inspection of the fire, decided there was only one way to fight the fire — foam. Only two units in Alaska were equipped with foam equipment, Elmendorf AFB and the Anchorage International Airport. It was decided to call on the Air Force because of its large inventory of equipment and bigger fighting force.

Air Force firemen included MSgt Roland H. Reiswig, Assistant Fire Chief Herbert Peck, SSgt Pete Riggs, SSgt Gary Judy, SSgt John Spahr, Sgt Mario Rivere, Sgt Claytis Thirdkill, Sgt William R. Walker, Sgt Donald R. Sadler, Sgt Haven Heath, Sgt Bob Furgerson, A1C John Rychlinski, A1C Richard Gonzales, A1C David McKenzie and Airman David Fisher.

"On behalf of the railroad," an official said. "I'd like to express our appreciation for the help the Air Force gave us during the fire. I don't know how we'd have done it without them."

CE

When You're Down, the Only Way to Go Is UPS

. . . UPS is going to solid state operation, and here's the account on what Headquarters AFCS has experienced.

by Jesse G. Kemp, PE, and Edward J. Dumaine, Jr, PE

That title may sound facetious but in this electronic age, it's entirely true. With our ever-increasing demand for reliable, constant, transient-free electrical power to drive today's sophisticated computer and communications-electronics complexes, the use of the Uninterruptible Power System (UPS) is spreading rapidly throughout industry and government.

UPS, of course, is not new — we are all familiar with the various configurations and machines that have been used over the years to achieve this desirable result — from the old crash-start diesel-driven generator that crashed as often as it started, through the rotary motor generator/floating battery system now in use in the overseas AUTODIN switching centers.

What is new is that UPS, like most other electrical devices in this age, is going to solid-state electronic operation — no moving parts. This, of course, opens up a whole new field of operation and maintenance for the Base Civil Engineer (BCE) shop. In the past, the electronics portion of the BCE's responsibility has been generally very small and restricted to certain diesel governor controls, intrusion alarm systems, and certain select air conditioning and fire detection systems. However, with the decision that the new solid-state UPS units will be a complete O&M responsibility of the BCE, his involvement in the area of electronics will now be significantly changed. We will explain some of the Air Force Communications Service (AFCS) background experiences in this area, and cite some of the problems involving the BCE that have been identified with these UPS systems. But, first, it may be well to briefly review what an UPS is; what it does; and how it is used.

An UPS unit is basically a power conditioning device used in between the incoming power supply and a critical load, such as a communications or computer load. The unit is not a power source in itself, but serves two purposes:

- Through the use of stored energy, it continues to furnish power to the load in the event of an incoming power failure until a back-up source of power, such as a diesel generator, can be started and placed on-line.
- It serves as a buffer device to dampen any fluctuations or excursions of commercial power and prevents these transients from being transmitted to the load.

A solid-state UPS, **Figure 1,** works basically on the principle that input commercial AC power is changed by a solid-state rectifier to direct current. The DC is then changed through a solid-state inverter to AC. The load being served is connected to the output of the inverter. A battery bank is floated on the DC buss. The battery bank serves as the source of stored energy (usually a 15-20 minute capacity) to carry the load in the event of an input power failure, and also furnishes the dampening effect for transients on the input power. With the UPS operating normally, the load would be served from the output of the inverter and the rectifier would be furnishing input DC power to the inverter, as well as keeping the battery in a state of charge. All components in this system are solid-state, except for cooling blowers provided for heat dissipation.

The advantages of having such a system as compared to those UPS systems which employ rotating elements, such as large flywheels (with clutch arrangement) for the source of stored energy, are the elimination of the multitude of problems associated with rotating machinery (such as bearings, brushes, vibration, etc.) and the inherent long life characteristics of solid-state electronic circuitry. These advantages, however, also have their price.

Engineers responsible for providing the support construction for installation of these devices must carefully investigate the environmental requirements which are critical to any solid-state device. Considerable heat is dissipated by these modules, and an adequate supply of clean cooling air is essential. We stress "clean" because dirt particles and electronic cir-

cuitry are completely incompatible. Battery rooms and racks must conform to current Air Force safety criteria.

Following the engineering and installation of this equipment, the BCE faces these problems: How do I maintain it? What kind of people do I need? Test equipment and tools? Spare parts? Are TOs available?

Many UPS manufacturers offer a package maintenance contract. Some BCEs may elect a contract if they do not have the organic capability and see no relief in sight for the acquisition of trained personnel. The time to procure these services is during the negotiation for procurement of the UPS, and the package should include the necessary logistic support. This is an expensive and sometimes undesirable choice, but as the units proliferate throughout the Air Force, it can in some instances be the best available means. A preferable solution is the capable and trained "blue suiter," probably the 543X0 Power Production Technician. Even though the familiar power production technician in our power plants has previously had little or no exposure to electronic circuitry, the solid-state UPS is power plant equipment. Our power plant operators must increase their capability to match state-of-the-art advances in their field. To date, our experience has been that this specialty is quite satisfactory for the O&M of these units, once the necessary electronic training has been accomplished.

ATC Responds to Training Needs

Air Training Command (ATC) has responded to our needs by setting up specialized training for some of our particular overseas equipment. This training will not be applicable, however, to other solid-state devices. We have identified our additional requirements to ATC for broad based solid-state electronics training for UPS.

Any BCE who is scheduled to acquire UPS modules should check his specifications carefully to ensure that all necessary technical data and instruction manuals are provided.

Logistic support which includes tools, test equipment and spare parts appears to be a problem as more and more UPS modules of various manufacture come into the Air Force inventory at locations scattered around the world. For those units being individually procured on a project-by-project basis, the BCE must determine that the necessary equipment and an adequate bench stock of spare components are included in the UPS procurement contract. Additionally, he must ensure that the future requirements for this material can be satisfied in a timely manner by the supply system in use at his base. The 200-KVA modules scheduled for installation at AUTODIN switching centers in the US, on the other hand, will be obtained under a common specification and will be procured and life-cycle managed by the Air Force. This will preclude the logistic support problem for this group of modules.

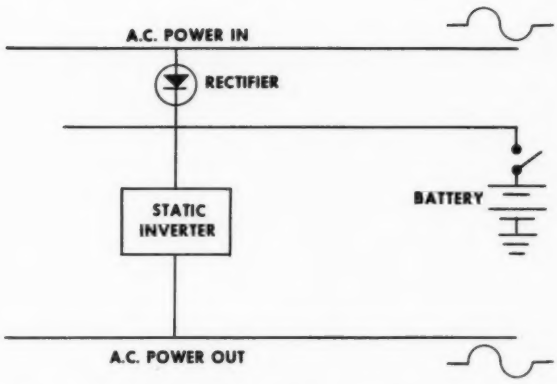

Figure 1: Floating Battery Solid State UPS.

AFCS, as an operating agency, is presently participating in the program to provide this advanced power equipment in the CONUS and overseas AUTODIN switching centers. We are also installing or programming installation of additional modules in other critical communications and computer locations worldwide. Other commands are also finding that they have a definite requirement for this equipment.

Therefore, we predict that within a few years, they will be fairly common appurtenances in most Air Force power plants. Careful resolution of the problem areas identified should ease our entry into the field of this new generation of power equipment. CE

JESSE KEMP *is an Electrical Engineer, Directorate of Engineering and Construction, Headquarters Air Force Communications Service, Richards-Gebaur AFB, Missouri. He received his bachelor's degree in electrical engineering from the University of Arkansas and is a registered Professional Engineer in Illinois.*

EDWARD DUMAINE *is an Electrical Engineer, Directorate of Operations and Maintenance, Headquarters Air Force Communications Service, Richards-Gebaur AFB, Missouri. A registered Professional Engineer in Oklahoma, he earned his bachelor's degree in electrical engineering from Louisiana State University.*

■ **AFR 86-7** dated 20 September 1972 provides considerable detail on what the responsibilities of a Base Facilities Board (BFB) are and how these responsibilities should be carried out. There has been a definite trend in recent times towards committee management and it has been proven that this type management is successful when properly directed. The success or failure of your BFB could then be measured by a critical look at a few major points. If after examining the following points you come up with a negative response to one or more of the prime questions, it would be reasonable to say that your BFB is less than effective, is in trouble and should be changed accordingly.

- Do you have a clear and concise agenda?
- Does the Commander attend the meeting?
- Do the commanders of major staff activities and tenant units attend?
- Does the number of voting members range between nine and 12 people?
- Are personnel in attendance familiar with agenda items?
- Are actions, where possible, restricted to agenda items?
- Do attendees participate as top managers with a vested interest in dollars and property?

A famous general once said, "An organization does well those things a boss checks." Nothing could be truer. How many times have you observed the changes in certain things an organization does poorly when the boss starts checking? In most cases, the results are outstanding and, timewise, obtained in most cases literally overnight. There can be no substitute for command interest in any activity. For instance, bases where the Commander has emphasized the use of the BFB, the base has enjoyed considerably better management of a significant portion of the base's money and manpower resources.

You are probably saying by now, "I have heard this before." But, how many Commanders and Base Civil Engineers (BCEs) take a real, honest, no-strings attached interest in the BFB? Do you, Mr. Base Commander, attend your own BFB meetings? If you don't, you will not be the first nor the last. But, seriously

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They tell, in easy to unders

Get the Most Mile

by Col Frank A. Knapp a

now, how can you expect members of the Board to take an active interest if you don't? Can you tell any interested party for certain how many of your key staff and major tenant Commanders attended the last BFB meeting? Chances are that most of the attendees were substitutes and did not have the foggiest idea of why they were there. Result, obvious "rubber stamp" approval, no requirement for justifications of any requests or programs, no management of critical funds or manpower resources.

The Base Commander and the BCE should not only insist, but demand active attendance and participation by voting members of the Board. It is extremely difficult for a substitute to know his Commander's desire and to function in concert with the rest of the Board. For a Commander to treat the BFB as just another meeting and send a substitute, will in effect negate his vote.

How can you get their attention? One way is to ask questions of the members about agenda items

COLONEL KNAPP *is Commander of the 3902 Air Base Wing and Base Commander of Offutt AFB, Nebraska. He attended Stetson University and North Georgia College before entering the Air Force as an aviation cadet in 1942. He has held many important positions at various levels during his career.*

before the meeting starts. An interested member will have read the agenda and may have certain questions himself. Absence of any concern or answers can be easily detected and a suitable environment for self-motivation can be generated.

The cartoon depicts an exaggerated version of a disorganized meeting. The Commander should also insist on a well-planned and prepared agenda for the meeting and approve the agenda prior to the meeting. The BCE should carefully review the agenda with the Chief of the Programs Branch prior to submission for approval. In this light, a close, harmonious, day-to-day working relationship between the Commander

s who know what it's all about.
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leage Out of the BFB

pp and Col Harry H. Magazu, PE

and the BCE is in order. The Commander's interest in the BCE's business is not only a necessity but a must.

As the cartoon depicts, there is nothing more nonproductive than a long, rambling, disorganized meeting and literally everyone including the substitute members, second lieutenants and sergeants, "are turned off." To get your BFB meeting "up tight," there is no substitute for, in addition to command interest, proper planning and preparation. We recommend that the board be presented a list of all 332s with manhour/material cost estimates, and the BCE's recommendation. This should have been in the hands of all board members at least one week prior to the BFB meeting. Then they should be discussed "BY EXCEPTION" in priority sequence. One decision to be made during the planning process (which is, incidentally, accomplished by the Chief of Programs) is "Do I have enough or too much material to present to the Board?" Present only enough material to occupy the board for one hour or less. A long meeting kills the enthusiasm for the Board, provided you had it to start with.

The agenda should be "reviewed" by the BCE, Chief of Programs, Chief of Engineering and Construction, Chief of Operations and Maintenance, and Chief of Program Development. From the "pre-meeting," a unified set of BCE recommendations and agenda should be presented to the Base Commander for approval. The approved agenda should be distributed to the interested personnel on base as well as the voting members of the Board.

The Base Commander should open the meeting and the Recorder, the Chief of Programs, should conduct the meeting at the direction of the Chairman. Using the very simple agenda, the recorder moves rapidly from item to item, deviating from the short description of the item only where necessary and making recommendations. A vote is taken as quickly as possible and the next item is taken up. Justification for work requests must be made by the requestors, not the BCE. Deferred decisions can cause a Board to eventually become ineffective also.

By now you are wondering what, if after all this, I still do not have an effective BFB. No amount of planning and preparation can make an effective Board without: Command interest, planning and preparation, and keeping the meeting short and simple.

The integrity of the BFB and getting the maximum mileage therefrom are completely dependent on the aforementioned. Failure in any of these areas will degrade the Board to a needless entity. CE

COLONEL MAGAZU *is the Base Civil Engineer, Offutt AFB, Nebraska. A graduate of the University of Maryland with a bachelor's degree in civil engineering, he is a registered Professional Engineer in Vermont. Since 1952, he has held a variety of positions at squadron, numbered Air Force and major command levels.*

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Industrialized construction has paid off with big dividends for the Air Force. Here's the story on how the Air Force helps its personnel in PCS situations.

TLQs: A People Program

by Capt Eugene A. Lupia, PE

Tonight hundreds of Air Force families across the United States will turn the key to the on-base, low cost, temporary accommodations which they are occupying as a result of the recent completion of the Air Force Temporary Lodging Quarters (TLQ) project at that base.

When ground was broken one year ago this month at Norton AFB, California, it marked the beginning of an innovative development in Air Force housing acquisition techniques. The objective was a program to provide temporary accommodations for the typical Air Force family while seeking permanent housing at its newly assigned installation.

The Air Force TLQ program provided 760 living units and 38 service buildings (one service building for each 20 living units) at 18 Air Force bases in the continental United States, **Figure 1.** At 16 of these bases, there are 40 living units and two service buildings, while the other two bases, Lackland and Offutt, have 60 living units and three service buildings.

During Fiscal Year (FY) 1972, 732,812 permanent change-of-station (PCS) moves were made in the Air Force. Of these, 172,147 involved movements of military personnel with 384,408 dependents. Although the Air Force has an aggressive program to reduce the frequency of PCS moves, the average member relocates at least once every two years. Finding adequate housing, either on base or in the local community, presents a real challenge for most families. The Air Force has a programmable deficit of over 20,000 adequate family dwelling units, and this tabulation does not include the housing requirements of an additional 44,000 married, lower-grade personnel who are ineligible for military quarters, but who do require housing.

In an attempt to offset high prices and inconveniences for some of its people in PCS situations, the Air Force developed the TLQ program. Let's take a moment to go through some of the thinking involved.

The cost of feeding a family is a significant percentage of the total extra expense assumed by an individual on a move. Therefore, cooking facilities were considered an absolute requirement in the TLQ program if significant savings for the member were to be realized. Other programming factors included enough flexibility to accommodate a family of five and easy access to base support facilities such as the commissary and base exchange, as well as the airman's job. The facility had to be equipped with all of the furnishings necessary to permit a family to live for a short period of time.

TLQ planning was accomplished at Headquarters

Trees left standing add to the attractiveness of the site at Mather AFB, California where units were recently erected.

Furnished to accommodate a family of five, each unit has full kitchenette facilities. Color TVs are also provided.

US Air Force by a joint Personnel/Civil Engineering team, rather than at base level. The Air Force had an urgent requirement for TLQs at many bases and sufficient information was immediately available to permit Headquarters to make preliminary determinations. Following the initial selection of bases, the proposed list was sent to the major air commands for review comment. Some changes were made as a result of the major command review and the final base selection list was a completely coordinated product.

Economic feasibility was given highest consideration in the development of the TLQ program. In order to get the greatest possible value from the funds available for the program, Headquarters US Air Force included only locations where 40 or more units could be conservatively programmed and amply justified.

How did the TLQ program mark an innovative development in Air Force housing acquisition techniques? It combined the Turnkey Concept, Two-Step Formal Advertising, Industrialized Building Techniques and Relocatability, all previously used by the Air Force, into a Centralized National Procurement. This "pilot program" demonstrated that a competitively bid, nation-wide, industrial effort with centralized management could be used to the Air Force's advantage.

The Air Force wanted to make maximum use of the industrialized building industry's expertise in designing and building high-quality units of proven constructability and maximum durability at minimum cost. Therefore, it was determined that a total Turnkey, two-step approach in which one contractor would provide the design, construction, sitework, erection and furniture for the units, would be used. The advantages of a Turnkey, two-step approach are:

- It allows the contractor greater flexibility in design and permits the preparation of an innovative design for greater compatability with the local environment.
- It allows the utilization of local building codes (FHA Minimum Property Standards) which provide wide latitudes in selecting construction materials and methods. The current shortage of skilled labor and materials is greatly increasing construction costs, and freedom to use new sources of labor skills and materials will lower the total cost of the project.
- It allows the contractor to use his special skills and experience to provide the facilities required. Use of new construction methods and advanced management techniques will substantially reduce construction time and costs.
- It reduces the coordination time normally required between the designer and the contractor since one contractor provides both design and execution.
- It helps realize considerable savings in supervision, inspection, overhead and administrative costs for the project.

The project has been managed by the Housing Division of the Directorate of Civil Engineering, Headquarters US Air Force. The Air Force Civil Engineering Center at Tyndall AFB, Florida, provided procurement services and initiated a two-step, formally advertised procurement. The first step of this pro-

cont'd next page

Figure 1: Temporary Lodging Quarters Bases

Eglin AFB, Florida
Ent/Peterson AFB, Colorado
George AFB, California
Grand Forks AFB, South Dakota
Homestead AFB, Florida
Keesler AFB, Mississippi
Lackland AFB, Texas
Lowry AFB, Colorado
Luke AFB, Arizona
MacDill AFB, Florida
Malmstrom AFB, Montana
Mather AFB, California
Minot AFB, North Dakota
Norton AFB, California
Offutt AFB, Nebraska
Robins AFB, Georgia
Travis AFB, California
Williams AFB, Arizona

People Program

cont'd

curement technique saw the distribution of a Request for Technical Proposals (RFTP) in March 1971 to 170 prospective proposers (manufacturers - builders). The RFTP established the performance and quality standards of acceptable TLQ units. These standards were intended to permit proposers to submit proven "off-the-shelf" type designs.

Design parameters used in the procurement had these stipulations:

- Accommodate a family of five people.
- Provide full housekeeping capability.
- Locate the units convenient to base facilities.
- Provide personal privacy.

The Statement of Work contained the technical requirements. Construction was required to be accomplished from industrialized, modular units. Units had to be relocatable, yet present a permanent (not trailer-like) appearance. Single-story clusters with exterior entrances and convenient parking in clusters of eight to 12 units were specified. Construction quality standards were established as those contained in FHA Minimum Property Standards 2600 Multi-family Housing. Individual Base Civil Engineers, under the guidance of the major commands, completed a site selection report and outlined items peculiar to their bases to be included in the Statement of Work.

The proposers responded by submitting proposed solutions based upon their own expertise and experience. Of the 22 proposals received, 18 were declared acceptable. Nine proposers bid, and a contract for construction of 760 units at 18 bases was awarded on 23 November 1971 to Community Sciences Technology, Inc. (CST), Newport Beach, California. The modules were supplied to CST by Hallamore Homes, Inc., Santa Ana, California, from production plants in Fountain Valley, California; Colorado Springs, Colorado; and St. Petersburg, Florida.

Construction of a pilot model and preparation of detailed plans and specs were accomplished in December 1971 and January 1972. The requirement for relocatability was demonstrated when the pilot model was later disassembled, transported to Norton AFB and reassembled. The relocatable feature added flexibility in permitting the Air Force to meet changing needs with minimum impact or risk to private community enterprise. Relocatability has proven to be a minimal added expense, if any, under the industrialized concept.

The quarters constructed are identical nationwide, with only minor additions of extra insulation at those bases in colder climates. The modular, efficiency apartment-type units with 360 net square feet of usable space, are completely furnished to accommodate a family of five. Each unit contains an individual air conditioning/heating unit, wall-to-wall carpeting, and has a living/sleeping area, a compartmentalized bath, and a kitchenette with range, refrigerator and sink with garbage disposer. Fire protection is provided in each unit by a heat and smoke detector which sets off a local alarm and sends a signal to the base fire station. An industrialized service module containing a maid's storage area, with bathroom facilities, and a public area with washer, dryers and vending machines, was provided for each 20 living units. Site preparation, underground utilities, landscaping, sidewalks, parking areas, etc., were also provided to complete the facility on approximately two to three acres of Government-owned land.

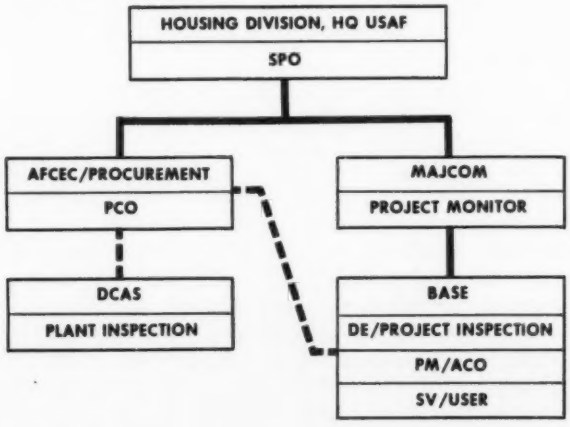
In order to make this a complete Turnkey project for the bases involved, certain furnishings not provided by the contractor were provided through the General Services Administration (GSA). Items purchased through GSA in one central procurement, with 18 delivery sites, included color TVs, linens, pots and pans, utensils, dishes, etc.

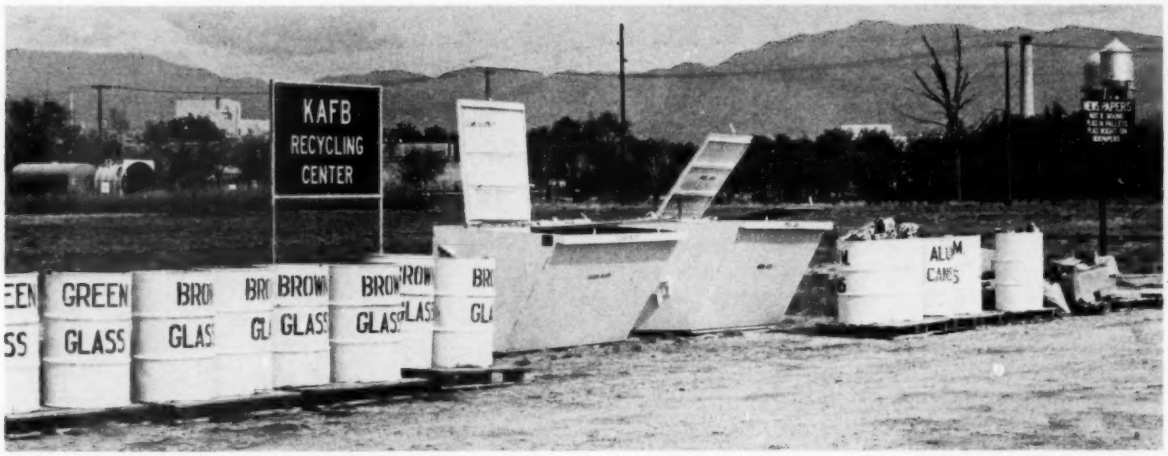
Funds to finance construction costs and to purchase furnishings were provided by the Air Force Central Welfare Board. A total of $9 million was expended for the project or $12,000 per living unit (completely furnished with costs of service buildings pro-

cont'd on page 25

CAPTAIN LUPIA *is now assigned to the Construction Branch, Housing Division, Directorate of Civil Engineering, Headquarters US Air Force. A 1967 graduate of the Air Force Academy with a bachelor's degree in civil engineering, he received his master's degree in civil engineering from Oklahoma State University in 1968. He is a registered Professional Engineer in Colorado and is a member of the American Society of Civil Engineers.*

Figure 2: TLQ Project Management Organization.





This is the neat, compact and well located recycling center at Kirtland AFB, New Mexico. Near the commissary, it has containers which are marked for glass and cans, which make up the largest volume. Newspapers are also collected.

Recycling means more than just recognizing the value of garbage. It means recognizing the value of the environment. Here are suggestions on

Recycling Today for a Better Tomorrow

by Capt Clifford E. Richardson

People in the United States generate at least 360 million tons of solid waste every year averaging 5.3 pounds of waste per person per day. Population growth increases about one percent annually but solid waste increases four to six percent. The U.S. makes up six percent of the world population, but uses 30 percent of its resources. Recycling has become a necessity to reduce the use of these resources. It is predicted that in another 15 years, the demand for wood will outgrow the supply. One ton of recycled paper will save 17 trees. If recycled paper accounted for 50 percent of all paper products instead of the current 20 percent, a forest the combined size of New England, New York, New Jersey, Pennsylvania and Maryland would be saved each year!

Recycling in the Air Force has as its basis The Resource Recovery Act of 1970, which states that there is a need for avoidance of waste through recycling. By mid-October 1971, seven major commands were each requested to select two bases to determine if there were possible markets to reduce the volume of solid waste on bases by recycling. By the end of December 1971, each major command had made its selections to perform a six-month study of recycling. Fourteen bases, **Figure 1,** were selected to determine:

- Availability of markets for recycling glass, paper and metal;
- Impact in family housing areas of separating refuse into separate containers;
- Economic aspects of the program.

As a result of this study, it is possible to draw a number of conclusions which may benefit all bases that desire to start a base-wide recycling program. The remainder of this discussion reports the results of the programs at the test bases and suggests ways for all bases to start their own recycling programs.

Instructions for establishing test programs were very general to allow relative evaluation of any feasible program. Base programs ranged from continuing their contract for removal of all trash, including recyclable materials, to establishing a collection area and allowing non-profit organizations to remove the materials at no cost to the government. Civil engineering conducted the whole recycling program. All bases used different means for collecting materials, depending upon the market availability in their location. One base contracted with the county which had set up a recycling center for all solid waste products in a regional plan. Three more bases could find no markets locally for their materials, therefore did not establish any centers. It was the local opinion of eight bases that each had a successful program and two bases had some markets available but low participation, and discontinued the program, **Figure 2.**

How to start a voluntary recycling program

Determine ready markets for all recyclable materials from the classified section of the local telephone book, procurement office or Redistribution and Marketing. A study of all base facilities and organizations should be made to identify organizations which use the most recyclable products. Insure that transporta-

cont'd next page

Recycling *cont'd*

tion is available to take items to market. About 500 families are needed before a successful program can be established. Use the Base Pollution Abatement Committee as a steering group for legal aid, publicity, marketing and coordination with various base activities, and gaining the base commander's support for the program. Consider contacting the local civilian community for volunteers and possible consolidation of shipments to the buyer.

Locate A Convenient Site

Locate at least one site (about 160 square feet) on base that is convenient to the potential user and readily accessible from the street. Preferably, it should be covered and/or fenced in. Give your project a name and identify the area. Identify all volunteers to run the program and insure that at least three people at one time (one adult) run the center during regularly posted hours, possibly twice a month. Obtain containers that will be large and sturdy enough for all materials, remembering that a 55-gallon drum full of crushed glass weighs 400 pounds and equipment will be required to handle it. Collect enough material for economical shipment, breaking all glass and flattening all cans at the site if not already accomplished. Provide utensils at the site for people to use. Record all transactions using a scale. Reach as many young people as possible to get them interested by using poster contests, lectures, poetry and essay contests, handouts, daily bulletins and the base newspaper. Work with the civilian community by helping them when possible and attending their meetings on conservation and related items.

Most bases have local markets for some kind of recyclable materials. Additional markets will become more plentiful as the idea of recycling increases. Family housing participation estimates ranged from 10 percent to more than 50 percent for all bases that reported a favorable program. The degree of participation is a function of advertisement, availability and convenience to the centers. A lack of publicity usually reduced quantity of materials collected. With adequate publicity, enough people will segregate recyclables from trash to make an economical program. It is necessary to have a manned center both to ensure proper segregation of materials and to keep the area clean because people always leave junk and garbage at unmanned centers. Available economic analysis from Kirtland AFB indicates that the break-even point of initial investment, that is, setting up, takes only seven months. There is evidence that the more money spent for locating many collection centers will increase the participation through convenience to make the initial investment worthwhile.

This 'mountain' of approximately 3½ tons of steel cans was the result of a recycling center that was left unmanned.

Test Could Not Be Determined

The two bases with the lowest number of housing units did not have any markets available to start their program. This is unfortunate since a true test of a low base population could not be determined. Independent private studies have indicated that 500 units is a lower unit.

Low participation on some bases with a large number of housing units indicates a lack of publicity since other bases with fewer housing units had a very successful program. Continued publicity is a necessity for a successful program.

CAPTAIN RICHARDSON *is Chief of Program Development, 4902 Civil Engineering Squadron, Kirtland AFB, New Mexico. He received his bachelor's degree in civil engineering from the University of New Hampshire, and is a member of the Society of American Military Engineers.*

Two means of collection were basically used by all but one of the bases that participated. One means was volunteer recycling centers where containers were provided for individuals to place their articles and the volunteers segregated the items by color and type, crushed cans and glass, tied papers and kept the areas clean. The materials were gathered to make shipment profitable. At other bases where manpower or volunteers were not available, a contractor was hired to set up and remove all materials from the center. The best form of contractor operated recycling center was a cost avoidance contract where the contractor would perform services for the government at a flat monthly fee to reduce excessive paperwork from the need to weigh and check books. Every base should also consider the possibility of advertising the annual refuse contract with an alternative provision for recycling items which could result in lower bids in the future. At one base, the Base Civil Engineer (BCE) conducted the entire program of establishing the recycling points, collecting the material and transporting it to market.

Tremendous Effort Required

For any base to have a successful program it requires tremendous effort and cannot be satisfactorily accomplished as an additional duty. A single point of contact for all environmental problems should be established at each base. In addition, funds and equipment must be provided initially for a successful program so that an adequate site can be established and maintained with the proper equipment to do the job. Recommended equipment is a baler/shredder for cardboard and paper, and a compactor for glass and cans. Equipment for moving the full containers should also be available.

At most bases, Redistribution and Marketing (R&M) was not set up to participate in the program. They had not recently established local contacts for these types of materials. The Defense Logistic Service Center should conduct a nation-wide survey of all available markets for all recyclable materials. This would help private industry realize that the Federal Government is establishing markets and providing a demand for industry that would process recyclable materials. R&M manuals and regulations should be updated to insure their ability to accept and process recyclable materials. Increased emphasis should be with R&M and the BCE to insure that sanitary landfills are accepting only items which can be sold by R&M.

Changes will have to be made at a national level. Favored treatment for virgin materials dated from the time in American history when it was considered desirable for business men to exploit the national resources to stimulate business, and legislation was passed for this purpose. We are fast learning that these resources are quickly being depleted. Now legislation will be required to reverse this trend. Changes should include federal law which has already changed specifications for paper contracts to include 3 to 50 recyclable content. More corporations should follow this lead. Additional laws should reverse corporate economics by reducing freight rates for recycled products making them easier and cheaper to acquire. Do away with the forester's depletion allowance which would encourage newspaper users to use recycled paper.

Consumer indifference should be discouraged to force companies to use more items containing recycled products, boycott items that are made from, or wrapped in, nonrecyclable products, and demand that more industries that process recyclable products be allowed to establish themselves. Local city zoning should be reviewed to allow recycling centers to be established in areas convenient to the users.

Recycling means more than just recognizing the value of garbage. It means recognizing the value of the environment. Recycling will come of age nationally when it is seen that the ability of the environment —air, water and empty land—to carry away garbage is a resource in itself which must be guarded. In the very near future, recycling will be a necessary way of life for all individuals living in this affluent society and everyone should do his part in protecting our natural resources so that the next generation may enjoy them to their fullest capability. CE

Figure 1: Bases Designated for Recycling

1. Otis AFB, MA (ADC)
2. McGuire AFB, NJ (MAC)
3. Myrtle Beach AFB, SC (TAC)
4. Moody AFB, GA (ATC)
5. Brooks AFB, TX (AFSC)
6. Carswell AFB, TX (SAC)
7. Sheppard AFB, TX (ATC)
8. Tinker AFB, OK (AFLC)
9. Kirtland AFB, NM (AFSC)
10. March AFB, CA (SAC)
11. George AFB, CA (TAC)
12. Hamilton AFB, CA (ADC)
13. Travis AFB, CA (MAC)
14. McClellan AFB, CA (AFLC)

Figure 2: Results at test bases.

AF BASES	# HSG UNITS	TYPE * COLLECTION	CONSIDERED SUCCESS	REMARKS
OTIS, MA	1195	DRUMS	YES	
McGUIRE, NJ	1755	CONTRACT	YES	DISCONTINUED (LOW PARTICIPATION)
MYRTLE BEACH, SC	800	DRUMS	YES	
MOODY, GA	300	—	—	NO MARKETS
BROOKS, TX	170	—	—	NO MARKETS
CARSWELL, TX	800	CONTRACT	YES	
SHEPPARD, TX	1112	DRUMS	YES	
TINKER, OK	1000*	DRUMS CONTRACT	NO	DISCONTINUED (LOW PARTICIPATION)
KIRTLAND, NM	2207	DRUMS CONTRACT	YES	
MARCH, CA	713	DRUMS CONTRACT	YES	
GEORGE, CA	1600	DRUMS	YES	
HAMILTON, CA	1449	DRUMS	NO	NO MARKETS
TRAVIS, CA	2000*	DRUMS	YES	TO START COLLECTION OCT 72
McCLELLAN, CA	675	CONTRACT	—	GARBAGE CONTRACT WITH COUNTY

* CONTRACT – BASE HIRED A CONTRACTOR TO SET UP PROGRAM
DRUMS – BASE SET UP AREAS ON THEIR OWN AND SOLD GOODS

Arresting barrier systems are classified as emergency equipment just as parachutes and ejection seats. Here's a complete overview on the systems and a report on

What It Takes to Stop the Aircraft

by David E. Cooper, PE

Aircraft arresting systems are properly included in the same general classification as ejection seats and parachutes—emergency equipment designed to protect crew members when the condition of their aircraft or its environment is unfavorable. As such, this equipment must have complete reliability and continuous availability.

The civil engineer's entry into the barrier business came about 20 years ago with the introduction of the MA-1 jet barrier. The fact that this system is still in use speaks well of its basic capabilities. Its major drawback other than weight/speed limitations and reset time is succinctly stated in a 1955 Barrier Vendor's brochure, "Damage To Aircraft":

"Damage is normally of minor nature considering the hazard. A barrier arrestment usually requires approximately 200 manhours to return aircraft to flyable condition. The fairing doors are indented or torn. The main landing gear struts are scratched or slightly grooved. External fuel tanks are normally damaged beyond repair."

The performance characteristics of jet fighters made it increasingly obvious that some external stopping device was frequently essential to their safe and economic operation. In order to accomplish this function without inherent airframe damage, an adaptation of the long established Navy hook and wire system was the natural choice. The Air Force has progressed through the BAK-5 and BAK-6 to the BAK-9s and 12s that are now the workhorses of the current barrier inventory.

Both the BAK-9 and the BAK-12 are self-energizing systems using rotary friction (B-52) brakes as the energy absorbing medium to stop the engaged aircraft. The BAK-9 has an energy absorbing capacity of 55 million feet/pounds during its 950 foot runout. Although dual installations have been made, the BAK-9 will be treated (within the limits of this article) as having a fixed configuration. The BAK-12 is currently found in three configurations, **Figure 1.**

The BAK-9 and BAK-12 are identical in operation. A nylon tape wrapped around a drum is pulled out by the aircraft. The drum turns and drives a hydraulic pump that provides pressure to the B-52 brakes that stop the rotation of the drum and halt the aircraft. The BAK-9 has two drums on a common shaft and uses two B-52 brakes. The BAK-12 has one drum on each side of the runway and uses four B-52 brakes. Both systems are speed and weight sensitive. Speed sensitivity is simply a matter of faster drum/pump rotation, with a subsequent increase in pressure to the brakes. Weight sensitivity is indirect in that with equal engaging speeds, at any time after contact, the heavier aircraft will have traversed a longer distance than a lighter aircraft. This condition exists due to the fact that for the first part of the engagement the percentage of developed pump pressure applied to the brake is essentially constant and, therefore, a direct function of aircraft speed. However, as runout exceeds 500 feet, a cam driven by the tape reels starts to apply an increasing percentage of developed pump pressure to the brake until the programmed runout is

approached and the bypass valve is completely closed. When this occurs the total pump pressure is delivered to the brakes.

The emphasis is on **developed PUMP pressure.** Once the pump pressure has exceeded the static pressure and popped the shuttle valve, any pressure applied to the brakes must be furnished by the pump. At the end of the arrestment, when the reel has stopped turning, the pressure in the hydraulic system is zero. When you have watched a 40,000 pound F-4 at 160 knots stopped in 900 feet, it is hard to believe that you could pull the system out almost the same distance with a pickup truck – provided you didn't try to go too fast. But that's the way the system works: it automatically integrates the continuously variable factors of aircraft speed, developed pump pressure and the effective tape radius arm to provide the energy level required to stop the engaging aircraft within the programmed runout. This is accomplished without "black boxes" by the mechanically simple, yet sophisticated, cam control valve.

Someone once said that the boat a man buys and the woman that he marries are both examples of an acceptable compromise. The cams that control the BAK-9 and 12 barriers are also good examples. Rather than being specifically tailored to meet the characteristics of one aircraft, they instead represent the optimum performance envelope within the barrier's capabilities and acceptable tailhook loadings.

The BAK-9 barrier was designed to meet the average requirements of century series aircraft. It has repeatedly demonstrated greater capability by successfully accepting F-4 approach end engagements. However, here is where that century series cam shows up. The aircraft is heavier and hotter than the system was programmed to expect. As a result, at 700 feet the plane is still moving briskly and producing a high pump pressure. The cam senses the end of the runout and dumps all the pressure into the brakes and stops

Figure 1: The Three Configurations of the BAK-12.

Nomenclature	Runout	Energy Capacity
Standard	950 ft	65 Million ft/lbs
Long Runout	1200 ft	85 Million* ft/lbs
Dual	2000 ft	300 Million ft/lbs

* Can be increased to 100 million with alternate cam.

the aircraft in the next 250 feet. This fairly rapid terminal deceleration puts a lot of stretch in that 1,000 feet of nylon tape and sets up the potential aircraft roll-back commonly called the "slingshot" effect. This maneuver is most disconcerting to pilots and has produced structural damage to hook assemblies. In itself, that is a good reason for using the BAK-12 for F-4 engagements whenever possible. Even better reasons are offered as an additive to the power production for the two systems, **Figure 2** and **Figure 3.**

The tapes have essentially the same cost, but the BAK-12 tape has three times the normal life of the BAK-9. In addition, it is not uncommon for the F-4 to engage with a speed/weight combination that puts a BAK-9 arrestment into the Regime III category that requires immediate tape replacement. To sum it all up, the BAK-9 will accept a F-4 approach engagement, but in so doing, it will be working at the upper limit of its design parameters.

The BAK-12 compatability with the total DOD inventory of hook-equipped aircraft has been well demonstrated. Within Tactical Air Command (TAC), it is recognized as our primary system with the BAK-9s because of their overrun action and lesser capabilities functioning as a back up system. The extremely vital role played by aircraft arresting barriers in Southeast Asia operations has had a significant impact on barrier use concepts at stateside bases. In the not too remote past, a barrier engagement was considered a last-ditch emergency, sort of the ground

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Figure 2: BAK-12 Tape Replacement Criteria.

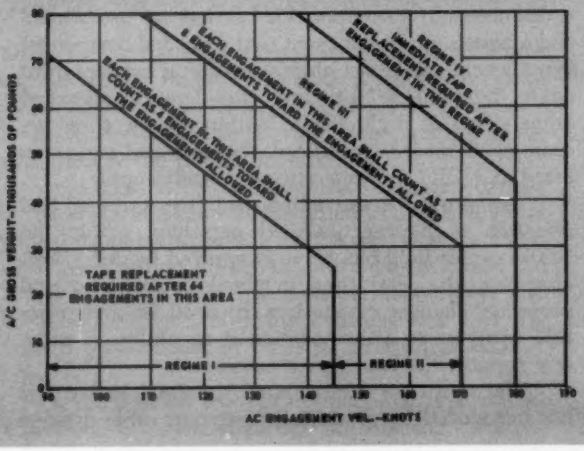
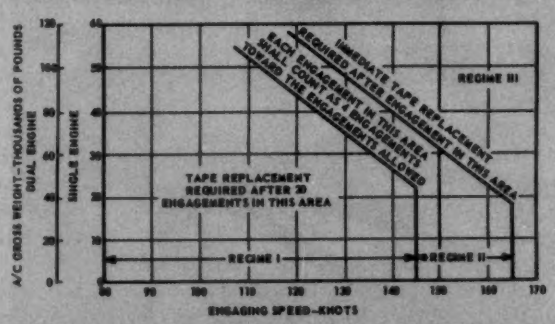

A/C GROSS WEIGHT—THOUSANDS OF POUNDS
AC ENGAGEMENT VEL.—KNOTS
REGIME I
REGIME II
REGIME III
REGIME IV
IMMEDIATE TAPE REPLACEMENT REQUIRED AFTER ENGAGEMENT IN THIS REGIME
EACH ENGAGEMENT IN THIS AREA SHALL COUNT AS 2 ENGAGEMENTS TOWARD THE ENGAGEMENTS ALLOWED
EACH ENGAGEMENT IN THIS AREA SHALL COUNT AS 4 ENGAGEMENTS TOWARD THE ENGAGEMENTS ALLOWED
TAPE REPLACEMENT REQUIRED AFTER 64 ENGAGEMENTS IN THIS AREA

Figure 3: BAK-9 Tape Replacement Criteria.


A/C GROSS WEIGHT—THOUSANDS OF POUNDS
DUAL ENGINE
SINGLE ENGINE
ENGAGING SPEED—KNOTS
REGIME I
REGIME II
REGIME III
IMMEDIATE TAPE REPLACEMENT REQUIRED AFTER ENGAGEMENT IN THIS AREA
EACH ENGAGEMENT IN THIS AREA SHALL COUNT AS 2 ENGAGEMENTS TOWARD THE ENGAGEMENTS ALLOWED
TAPE REPLACEMENT REQUIRED AFTER 20 ENGAGEMENTS IN THIS AREA

NOTE: EACH TAPE PULLOUT/REWIND CYCLE MADE TO COMPLY WITH SECTION 3-14 MONTHLY INSPECTION SHALL COUNT AS ½ ENGAGEMENT. ANY ENGAGEMENT BELOW 80 KNOTS WILL BE CONSIDERED AS AN ENGAGEMENT IN REGIME I.

EXAMPLE: TAPES IN SERVICE 18 MONTHS – COUNT 9 ENGAGEMENTS.
ONE (1) ENGAGEMENT IN REGIME II – COUNT 4 ENGAGEMENTS.
SEVEN (7) ENGAGEMENTS IN REGIME I – COUNT 7 ENGAGEMENTS.
TOTAL COUNT 20 ENGAGEMENTS – REPLACE TAPES.

What It Takes
cont'd

DAVE COOPER *is Chief of the Equipment Branch, DCS/Civil Engineering, Headquarters Tactical Air Command, Langley AFB, Virginia. A graduate of Lehigh University with a bachelor's degree in mining engineering, he is a registered Professional Engineer in Massachusetts and Maine.*

equivalent of an ejection. We now use them routinely in the prevention of emergency situations. It is in this phase, approach end engagements, that our more sophisticated barriers have made their greatest contribution to safer and more economic aircraft operations.

At the same time, the necessary up-runway location and the high energy absorption requirements associated with this technique have produced stringent maintenance parameters that must be observed. The timely and proficient maintenance of these systems is a vital factor in the safe operation of fighter aircraft. Barrier maintenance is a cyclic operation divided into daily, weekly, monthly/and semi-annual intervals.

One of the most serious problems the barrier maintenance crews face is the simple act of gaining access to the barrier and/or runway to perform the maintenance work dictated by the technical orders. The requirement and mechanism for expedient civil engineering access to the runway should be firmly preestablished by staff action and not delegated to individual negotiations at working level as the need arises. In order to expedite the monthly inspection which involves a tape pull out, TAC has evolved a "first Saturday" procedure named for the date selected at Langley AFB. On the first Saturday of every month, the runway at the base is closed for four consecutive morning hours for barrier maintenance. The closure is coordinated through base operations and TAC operations to Air Force, and results in a highly satisfactory arrangement.

The overall reliability of our BAK-9 and BAK-12 barriers has been outstanding. They have successfully arrested aircraft under conditions that would not unfavorably reflect on the equipment's performance had it failed. However, as with any mechanical device, the system components can be overstressed and/or damaged. The goal in TAC is the ability to correct any barrier deficiency and return the unit to operational condition within a 24-hour period. We have not always been successful.

This F-100 was undamaged after an approach end engagement necessitated by a left main gear malfunction.

Complicating Factors Explained

Two major factors complicate the problem:

- The overseas imbalance for personnel in the power production specialty makes it extremely difficult to retain properly trained barrier personnel in the CONUS.
- The sporadic and totally unpredictable demands for barrier components (tapes, pendants, shuttle valves, sheaves, etc.) do not lend themselves to the current austere supply management techniques. Therefore, the timeliness of the necessary repair is a direct function of the Base Civil Engineer (BCE)/Base Supply response capability. For this reason it is essential that the BCE and logistics personnel work closely together to assure that the special levels and exception codes necessary to support the barriers are established and maintained. In the event that a needed component is not locally available, aircraft arresting barriers must enjoy the same priority and consideration accorded other safety of flight items. Within supply, these requirements must be validated, requisitioned and processed as NORS (not operationally ready-supply).

The problems associated with the training and retention of barrier qualified personnel within the 543X0 career field has been recognized by Air Force. However, the lead time involved in manning and personnel changes emphasizes the need for a vigorous OJT program to assure continued capability to properly support the base flying mission.

The up-runway location of the BAK-12 barriers has introduced the problem of pendant cable damage

to the pavement. It is probable that attempts to correct this unsightly condition have caused more problems than they have corrected. In itself, the existence of the cable groove(s) does not constitute an operational deficiency. Until pavement attrition reaches the point where sharp spalling is produced and/or barrier reliability is compromised by inadequate pendant height (1½ inches), remedial action is seldom advantageous.

The ultimate solution to the problem involves acquisition of the BAK-14 cable control system that is currently being developed. Since it is not likely that the BAK-14 will gain production status in the immediate future, an interim fix is required. Experimental work at Shaw AFB, South Carolina, has developed a Stress-Relieved Epoxy System that shows considerable promise for under-pendant pavement repair. The method is being given further testing at other TAC bases.

The "operation" of aircraft arresting systems is an after-the-fact procedure. A barrier is like a mousetrap in this respect. Its function is performed automatically and personnel are required only to reset the system for the next engagement. In the CONUS, the barriers are emergency gear; the next engagement is often a week or two away. As a result, the real operation of the barriers involves the routine functions required by **AFR 55-42** in response to runway direction changes. There is little personal gratification associated with the removal of a couple of hundred feet of cable from an overrun on a cold, rainy, miserable night . . . but this is the job that must be done.

There is little doubt that the proliferation of barriers (12 at Nellis AFB and Luke AFB) and the operational requirements of a mixed aircraft inventory have created problems that did not exist as late as 1965. It is also true that the reset requirements of a BAK-12 are completely different from those of the MA-1. It is equally true that the rewind procedures of the BAK-9/12 barriers are no more complex than the operation of an automobile and certainly far less critical than the ejection systems of our current fighters.

The responsibility for the operation and maintenance (O&M) of aircraft arresting systems is charged to the BCE. This O&M function must be performed within his available resources. Under theater of operations conditions, 24-hour barrier O&M is a specific function of an authorized crew. However, in the CONUS, barriers are recognized as emergency gear and the manning requirements for their maintenance are authorized as an additive to the power production function. In TAC, this additive averages three men per base which is obviously inadequate for the barrier "operation" defined earlier.

Historically, the fire department has been closely identified with barrier operation as a natural extension of its crash rescue function. In the beginning, every engagement was an emergency. Today, the precautionary engagement could become a full blown emergency in the event of a missed engagement or system malfunction; so, as in the past, the fire department responds to all engagements. It is this reservoir of skilled manpower that provides barrier operational capability to the BCE posture. In TAC, the cooperative responsibility of power production maintenance with fire department assistance has proven to be the optimum arrangement under existing conditions. Men in the power production field have training in the basic skills needed for barrier maintenance. The fire department has the response and manning needed for barrier operation. The BCE has the responsibility for the effective integration of the two functions. **CE**

People Program

cont'd

rated). Unlike the other Armed Services, the Air Force has elected to finance its TLQ program by grant rather than by loans. This was done primarily because the Air Force wished to provide these facilities to the individual at the lowest possible cost.

An urgent need for temporary accommodations for Air Force families was identified to the Directorate of Civil Engineering and in a little over two years that need was satisfied at 18 Air Force bases across the United States. It was only with the cooperation and through the efforts of many organizations that the finished product was in place in a record amount of time.

Figure 2 shows the TLQ project management organization. As indicated earlier, the Housing Division, Directorate of Civil Engineering, acted as the Special Project Office (SPO) and Air Force Civil Engineering Center as the Procurement Contracting Office (PCO). The major commands monitored the projects at each of their bases. Base Civil Engineering personnel at each location assumed the responsibility for supervision and inspection of construction work for their respective projects and base procurement personnel assumed administrative control as Administrative Contracting Officers (ACOs). Defense Contract Administration Services (DCAS), which reported directly to the PCO, provided an inspector at each of the three production plants.

The TLQ program is a good example of how Air Force Civil Engineering personnel can use their engineering expertise and work with personnel officers, billeting officers and GSA representatives in a single-point management concept. Once again, Air Force Civil Engineering has played an integral part in a people program. **CE**

When Hq AFRES sought to locate a fighter aircraft gunnery bombing range near two communities and a wildlife refuge, the impact of the noise became a problem of real concern.

Why Environmental Statements?

by Capt Francis T. Sanpei, PE, and Vernon A. Justice, Jr, RA

■ In increasing numbers, commanders of the Air Force installations are asking these questions:

• Why do we need to write environmental statements?

• Are they really necessary, or are they just more paperwork?

In order to better understand the requirement for writing environmental statements, it is necessary to go back to 1 January 1970 when the President signed into law the National Environmental Policy Act (NEPA). Along with other basic Federal law policies relating to the protection of the environment, this Act included an "action-forcing" method to insure that Federal agencies consider the protection of the environment before taking any action. Subsection 102(2) (C) of the NEPA requires agencies to prepare, for all "major Federal actions significantly affecting the quality of the human environment (both adverse and beneficial)," a detailed written statement of what the environmental impact of that action may be. This does not mean that all actions having adverse environmental effects will be disapproved, for it is not the intent of the law to strive for "zero environmental damage." Rather, the intent is to force decision makers to not only base decisions upon economic, mission, political and/or technical factors, but also to include one additional consideration . . . the environment! Hopefully, in the process of preparing, reviewing and considering the implications of environmental statements, decision makers will find ways of accomplishing mission objectives while minimizing environmental impact.

To assist major air commands in complying with the NEPA, Headquarters US Air Force published AFR 19-2, Environmental Assessments and Statements, which furnishes guidance for the preparation of environmental statements and gives examples as to the type of Air Force actions requiring impact statements. The NEPA requires an environmental statement for "major Federal actions significantly affecting the quality of the human environment." It indicates that statements must be written **only for major actions with significant effects.** "Major" and "significant" are relative and require an exercise of judgment. Headquarters US Air Force has authorized major air commands to make the decision as to whether a proposed action requires a formal written statement. However, all proposed actions must be assessed, and if the major air command determines that the action may have a significant effect on the environment or may be highly controversial, a formal written statement is required.

Environmental statements must be written addressing these points:

• The environmental impact of the proposed action.

• Any adverse environmental effects which cannot be avoided.

• Alternatives to the proposed action.

• The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity.

• Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

• Details of unresolved controversies.

Headquarters Air Force Reserve (AFRES), Robins AFB, Georgia, recently complied with the NEPA and included the consideration of environmental

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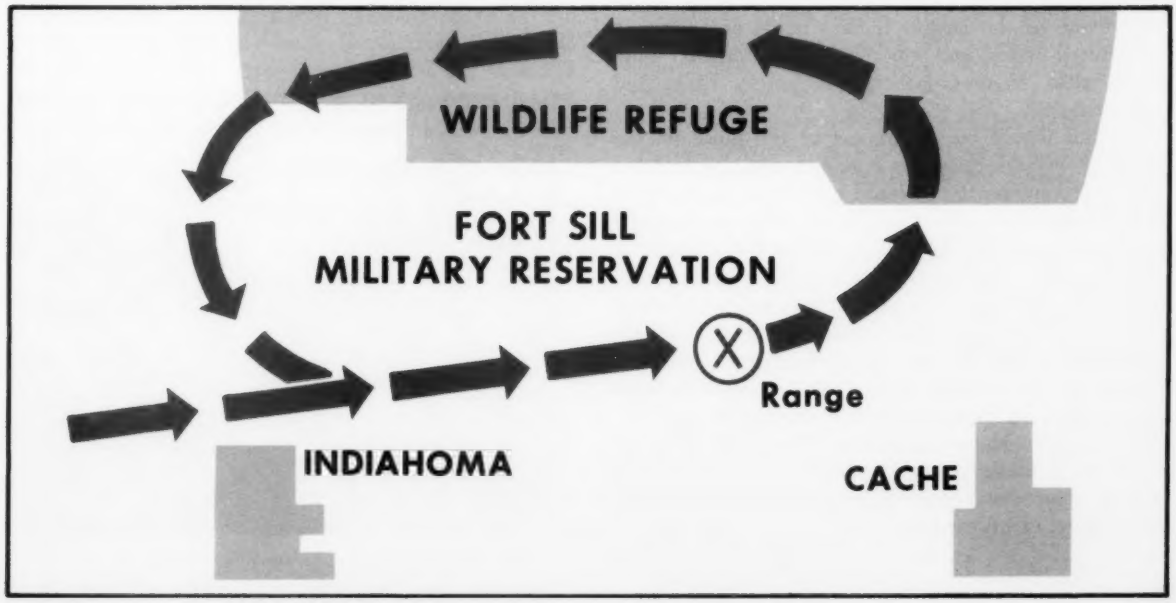
The flight pattern of F 105 aircraft avoided flying over the communities of Indiahoma and Cache but necessitated flying over a portion of the wildlife refuge. Aircraft noise did not appear to affect a herd of grazing buffalo.



Environment
cont'd

values into its decision-making process for a proposed mission change. The increased responsibility of AFRES in the defense of the country necessitated the training of pilots in F 105 aircraft. The fighter squadrons are based at Tinker AFB, Oklahoma, and Carswell AFB, Texas. This mission change required a fighter aircraft gunnery bombing range in close proximity to the bases. It was determined that an existing US Army artillery range at Fort Sill, Oklahoma, satisfied all requirements from an operations standpoint and was available for use. Actual construction required to support the new mission was minimal; however, before the decision to use this artillery range could be finalized, AFRES planning officials recognized that environmental factors had to be considered. If the decision to use the Fort Sill range was made, without considering the environmental factors, the Air Force would not have been in compliance with the NEPA. A lawsuit could be brought against the Air Force resulting in unnecessary operational delays and embarrassment.

The use of the Army range by F 105 aircraft did not appear to have any appreciable impact on the air and water qualities of the area. However, of great concern was the anticipated increase in noise to the surrounding areas created by the aircraft. The Wichita Mountain Wildlife Refuge and two communities, Cache and Indiahoma, lay adjacent to the artillery range. The flight pattern proposed by operations avoided flying over populated areas but necessitated flying over a portion of the wildlife refuge at a minimum elevation of 3,000 feet and penetrated 2,500 feet into the refuge area. The wildlife refuge contained one of the largest buffalo herds anywhere in the United States, and was refuge for deer, elk, longhorn cattle, coyotes, bobcats, migratory birds and other wildlife.

What would be the impact of the noise on the wildlife? Would there be vigorous complaints from the local communities? Would use of the range result in significant environmental effects or be controversial and, therefore, require a formal written statement? Also, in view of these environmental considerations, were there perhaps other alternatives instead of using the Fort Sill range which would satisfy mission requirements while minimizing environmental impact? Rather than avoid these questions, the AFRES Environmental Protection Committee was tasked with answering them. The committee addressed its efforts towards three areas of concern: alternatives to proposed action; community response to proposed action; and noise effect of proposed action.

Alternatives

The NEPA requires that alternative ways of accomplishing objectives of any proposed action be discussed in the environmental statement. One of the alternatives is always not to take any action. In other words, the statement requires information sufficient to permit a rational choice of alternatives.

AFRES discovered that all other existing bombing ranges were either unable to handle its mission or were beyond the operational range of F 105 aircraft without refueling or staging from other bases. Neither refueling nor staging was operationally desirable in view of the additional problems related to air refueling and increased maintenance support required at the staging base. The lack of training facilities for the ammo crew was also a constraint.

The alternative of taking no action would adversely affect the AFRES mission. Without a range for weapons training, flying personnel would not become combat proficient and tactical fighter groups would not attain combat readiness.

Community Response to the Proposed Action

An important consideration in the preparation of environmental statements for proposed actions is public opinion. Private organizations and individuals are entitled to review environmental statements and to comment on their adequacy, accuracy and comprehensiveness.

AFRES planning officials decided to inform local community officials of the proposed action, recognizing that if there were any objections, they could be "aired" and eventually resolved. Important city officials, the wildlife refuge manager, state health officials and region Environmental Protection Agency officials were invited to a luncheon. Dignitaries from AFRES also attended the luncheon at which time a

State of Oklahoma and Environmental Health Lab technicians record impact of aircraft noise on equipment.

CAPTAIN SANPEI *is a Course Director, Civil Engineering School, Wright-Patterson AFB, Ohio. He received his bachelor's degree in civil engineering from the University of Hawaii and his master's degree in civil engineering from California State College. A registered Professional Engineer in Hawaii, he also is a Diplomate in the American Academy of Environmental Engineers.*

VERNON JUSTICE *is an Architect at Headquarters Air Force Reserve, Robins AFB, Georgia. A graduate of Oklahoma A&M, now Oklahoma State University, with a bachelor's degree in architecture, he has over 10 years Federal service. He is a Registered Architect in Florida and Missouri.*

briefing on the proposed action was presented. The briefing included the rationale for the selection of the Fort Sill range over the other alternatives, planned range operations, description of flight and holding patterns and actions to be taken to minimize hazards. Overall, it was an honest appraisal of the use of the range. The guests were then invited to witness a test flyover demonstration simulating the use of the Fort Sill range and to observe the recording of noise data.

The luncheon was a success and served to improve community relations. City officials were impressed by the sincere concern expressed by the Air Force for the welfare of the community, the surrounding environment, and the feelings and opinions of the people living in the area. No one in attendance had any objection to the proposed use of the range.

Noise Effects

The NEPA requires that an impact statement discuss all known and possible environmental consequences of the proposed action. The most significant effect in the proposed use of the Fort Sill range was noise.

The US Air Force Environmental Health Laboratory at Kelly AFB, Texas, was contacted for assistance in conducting a noise survey. The objective of the survey was to quantify noise levels from the F 105 operations. An actual test flyover by a flight of F 105 aircraft simulating the use of the range was conducted to measure noise levels in order to estimate its impact. State of Oklahoma Department of Health personnel were also invited to assist and witness the noise survey.

Noise measurements were taken at the wildlife refuge, and the communities of Cache and Indiahoma. Standard community noise assessment techniques, based on human response, could not be applied in the wildlife refuge since the concern was for the potential effect of aircraft noise on wildlife. Buffaloes were observed during the test flyover and the noise appeared to have no effect on them. They continued to graze throughout all aircraft passes. The maximum noise level measured in the wildlife refuge was 89 decibels A-weighted (dBA). This indicated that possible effects to people visiting the refuge would be limited to occasional annoyance and distraction.

The noise levels measured at the communities of Cache and Indiahoma were not higher than traffic noise (67-80 dBA). The data collected supported the conclusion that the noise would have a minor effect on the people living in the communities. Also, the noise would have little effect upon the wildlife in the refuge area.

Each formal written environmental statement must progress through four stages: assessment, candidate statement, draft statement and final statement. With the information obtained, the AFRES Environmental Protection Committee wrote a "candidate" statement. The facts now available to the committee supported the conclusion that use of the Fort Sill Army artillery range for a F 105 bombing range would not have a significant effect on the environment or be controversial. Upon review of the "candidate" statement, the Air Staff's Environmental Protection Committee decided that this statement need not progress through the final stages of a formal written environmental statement. If this was the case, then was the preparation of the "candidate" statement unnecessary? No, because without the facts obtained through the preparation of the "candidate" statement, AFRES would not have been able to conclude with any assurance that the environmental impact would not be significant. However, had the facts shown that the effect would be significant, the "candidate" statement would have been used and developed to the next stage.

AFRES complied with the NEPA in fully assessing the proposed action. The "candidate" statement was a record which indicated, for future reference, the reasons why a detailed formal written statement was considered unnecessary.

In order for the environment to have a real role in final decisions, Air Force decision makers must consider environmental factors at the earliest possible stage. If this is done, the requirement for environmental statements should not delay completion of proposed actions. It is time for everyone to do more that pay "lip service" to the case for the environment, and to take positive actions toward its protection. The requirement for environmental statements is an "action-forcing" mechanism to do just that. CE

Journal Marks 13th Year with Aims Toward New Goals

With publication of this issue, the **Air Force Civil Engineer** journal observes its 13th continuous year of publication since founding in 1960. Celebrating any special occasion affords a time for reflection, and by the same token, provides a time for projection.

Debut of the Journal on 1 February 1960 marked the beginning of a concerted effort by the Director of Civil Engineering to provide a medium of communication for the exchange of professional ideas and information which would result in a more effective civil engineering function in the Air Force. Those responsible for its founding became acutely aware of the pressing need for improving the professional image of the civil engineering work force. A Professional Development Program was introduced and one of the vehicles to assist in achievement of the goal for a truly professional civil engineering work force was the establishment of a professional engineering publication.

Two objectives stand out foremost in the goals of the publication: one, to provide a professional medium of communications for the career field, and two, to improve the professional image of Air Force Civil Engineers.

Thirteen years have passed since that first issue, and it can be said that the Journal has kept pace with those objectives. Its value can be measured by statistics which reveal the number of professional articles published and the number of Air Force Civil Engineers who have authored those articles. In the 52 issues published since 1960, 618 technical articles have been presented, and 599 of those articles have been authored by Air Force Civil Engineers. The Journal has provided the means for civil engineers to grow professionally, and they have responded by writing technical articles and other valuable engineering - oriented information which has assisted in the aim for a more effective civil engineering function in the Air Force.

When civil engineers caught their first glimpse of the November 1972 issue of the Journal, they immediately recognized a departure from what in the past was a specific relationship of the illustration on the front cover to specific civil engineering activities. Instead, what they saw were combat aircraft and a reproduction of a plaque which hangs on the door leading into the office of Air Force Chief of Staff, General John D. Ryan. "The mission of the Air Force is to fly and fight," it reads. "Don't you ever forget it."

The intent was to remind the entire civil engineering community of the "fly and fight" purpose of the Air Force. It is a purpose that is fundamental to everything we do in Air Force Civil Engineering and one that should never be far from our awareness.

With this in mind, and in the issues to come, the Journal pledges to continue to foster the objectives set forth when it was founded. Those objectives are as relevant today as when they were first established. The Journal will continue to provide the means for publication of technical articles which will add to the professional status of the entire civil engineering work force. It will publicize in every way possible the direct support relationship of the civil engineering mission to the Air Force operational mission.

Finally, the **Air Force Civil Engineer** journal will engage all the creative and imaginative energy it can bring to accomplish this end. It will require the best efforts and ingenuity of all of us in civil engineering. We trust that all Air Force Civil Engineers will agree that it is worth the effort. **CE**

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